MULTICOLOR EMITTING FIELD LIGHT EMITTING LAMP

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1 **MULTICOLOR EMITTING FIELD LIGHT EMITTING LAMP**
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MULTICOLOR EMITTING FIELD LIGHT EMITTING LAMP

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[Name of Document] Specification

[Title of the Invention]

MULTICOLOR EMITTING FIELD LIGHT EMITTING LAMP

[Scope of Claim]

A multicolor emitting field light emitting lamp formed by laminating an illuminant layer and a transparent electrode layer, and a light conversion layer in which light conversion elements of each different characteristic are arranged in each position corresponding to segmented electrodes, on the segmented electrodes formed on an insulating substrate and connected to each different power supply, wherein color conversion of light emitted by the segmented electrodes is performed in the light conversion layer.

[Detailed Description of the Invention]

This prevent relates to a field light emitting lamp, or especially a multicolor emitting field light emitting lamp which can obtain with an optional color in the same light-emitting face.

A conventional field light emitting lamp (EL device is merely called itself as follows) adopts a structure wherein an illuminant layer in which fluorescent materials are dispersed in a binder of high permittivity is interposed between a pair of electrode layers in which at least one of them is light-transmittable, and the periphery is covered with an insulator of moisture resistance, and has characters such as small and lightweight, thin-shaped low electric power consumption, and is used as various display apparatuses and a back light of a liquid crystal device. Meanwhile, the EL device having the various superior characters in this way, however, the emitting color thereof is mainly decided by the kind of the fluorescent materials used for the illuminant layer, so that the light emitting with the particular emission spectrum distribution which the fluorescent materials have is performed, and conventionally a ZnS/Cu based fluorescent material of green that provides high luminance and long life is mainly used. And a method such as changing the composition of the fluorescent materials, using color filters, or changing an applied power supply frequency is tried as a method for obtaining color display of other various colors. However, in the method for changing the composition of the fluorescent materials, luminous efficiency and life properties of these fluorescent materials are different significantly. Then fluorescent materials except the ZnS/Cu based fluorescent material having a

center wavelength in 490 mμ to 530 mμ is hardly put into practical use because of their low luminous efficiency and short life. In addition, when the color filters of various colors are put on a light emitting face of the EL device, light except in the particular wavelength band of these filters is absorbed, so that there is a defect in becoming dark in general, and otherwise in the method described above, various kinds of color is difficult to display on the same light emitting face. In addition, in the method for changing the applied power supply frequency, the light emitting color can be changed on the same light emitting face, however, power supply of the EL device becomes complicated, and additionally, the emission spectrum distribution of the fluorescent materials, that is, the light emitting color cannot be changed significantly, so that a variable range of display colors is extremely small after all. As above, the conventional EL device is not suitable for colorfully displaying with multicolor, and the application field of the invention is limited by itself.

The present invention has made in view of the above, an optional light emitting color can be provided, and a new EL device in which various kinds of light emitting color can be provided by one EL device. Hereinafter, an embodiment of the present invention is described in detail with drawings.

Fig 1 is a multicolor emitting EL device 1 according to the present invention. In the drawing, reference number 2 is a base film for a back electrode. And reference number 3 show back electrodes which are formed on this film 2, which comprises segmented electrodes 3a, 3b, and 3c formed on the film 2 so as to be dispersed approximately uniformly, with being disposed in pectinate shape so that the ternary minute striped patterns are not confounded with each other, as shown in Fig. 2. And, for example, it is formed on the film 2 made from resin by a printing method, a vapor deposition method or plating. Reference number 4 is an illuminant layer which is laminated on the back electrodes 3, which comprises a fluorescent material layer formed by dispersing ZnS/Cu based fluorescent material powder of green emission spectrum distribution of high luminance which has the center wavelength in 490 mμ to 530 mμ into

high polymer which is high dielectric of cyanoethyl cellulose, and an insulator layer which is formed by dispersing high dielectric particle of titanium barium into high polymer having high dielectric of cyanoethyl cellulose, and which is provided by screen printing on the back electrode 3 equally. Reference number 5 is a transparent conductive film, which is formed by depositing indium oxide adjacent to a base film 6 for a surface electrode comprising a polyester film, for example, and which comprises a transparent electrode layer. And the fluorescent materials of a part where voltage is applied is excited, by applying voltage to each of this transparent conductive film 5 and the back electrode 3 having a structure so as to sandwich the illuminant layer 4 therebetween, and as shown in a curve a of Fig. 3, green EL light in which the peak is about 520 mμ and the emission spectrum distribution is 400 mμ to 650 mμ is emitted to the transparent conductive film 5 side. Reference number 7 is a light conversion film which formed on the base film 6 of a transparent electrode, comprising three elements of a blue filter element 7a, a green filter element 7b and a red wavelength conversion element 7c which convert the EL light to blue light (420 to 490 mμ), green light (490 to 560 mμ) and red light (590 mμ or more) respectively. Each element 7a, 7b, 7c is formed in the pectinate shape similarly according to the ternary minute striped back electrodes 3a, 3b, 3c. Curves x, y and z in Fig 3 are observation data by light-converting the EL light as shown in the curve a by these blue filter element 7a, green filter element 7b and red wavelength conversion element 7c, so that three primary colors of blue of 400 mμ to 520 mμ, green of 470 mμ to 620 mμ and red of 570 mμ to 720 mμ are obtained respectively. Each factor 7a, 7b, 7c of this light conversion layer 7 can be formed in an adhesion or printing method easily by using a fluorescence sheet or a fluorescent pigment in which characteristics of absorption or permeation of light and wavelength conversion properties are properly selected.

The noteworthly point in particular here is that ZnS/Cu based fluorescent material having high luminous efficiency, which has the peak of about 520 mμ and has emission spectrum distribution of 400 to 650 mμ is used as fluorescent materials, and therefore green

light having emission spectrum distribution of 400 to 520 mμ and blue light having emission spectrum distribution of 470 to 620 mμ, in which each has high luminance, can be obtained in the form dividing the emission spectrum of the EL light into two, by using the blue filter element 7a and the green filter element 7b. And additionally, red light of high luminance having emission spectrum distribution of 570 to 720 mμ can be obtained, in red of high wave length of 590 mμ or more, which is not provided in the EL light, by using a red wavelength conversion element 7c and converting the wavelength in the EL light. Next, reference numbers 8 and 9 are resin envelope films which protect the inside, and which interpose each side of the back film 2 and the converting layer 7 in the surface therebetween and sealed in a circumference part. In addition, the envelope film 8 in the surface whose surface is formed with irregularities doubles as a light diffusion plate which reflect diffusely the EL light converted in the light conversion layer 7 to emit outside.

Next, operation of an EL device 1 of multicolor light emission having such a structure is described. First, in Fig. 4, when voltage is applied between the segmented electrode 3a on back side and the transparent conductive film 5, fluorescent materials of the illuminant layer 4 which is laminated therebetween are excited, green light having high visibility shown in the curve a of Fig. 3 is emitted. In this light emission, microscopically, the light is emitted in the stripe pattern in the pectinate shape of the segmented electrode 3a, but in being seen macroscopically, the light seems to be emitted almost uniformly in the whole face because the segmented electrode 3a is formed on the back base film 2, with dispersed approximately uniformly with the minute pattern. And the green light in this pectinated shaped transmits the transparent conductive film 5 and enters the blue filter 7a of the light conversion layer 7 in minute stripe pattern, which is formed on the base film 6 of a front face in response to the segmented electrode 3a on a back face. In addition, wavelengths except for blue are absorbed in this blue filter 7a and the blue light shown in the curve x of Fig. 3 is emitted to the surface envelope 8 side. And then, irregular reflection is performed in the envelope film 8, and uniform blue light is emitted in the entire display face.

In the same way, when voltage is applied between other segmented electrodes 3b, 3c and the transparent conductive film 5, uniform green light or red light is emitted in each display face. In addition, when the segmented electrodes 3a, 3b, 3c are combined suitably and voltage is applied between each of these electrodes and the transparent conductive film 5, blue light, green light or red light which is converted as appropriate to each conversion element 7a, 7b, 7c of the light conversion layer 7 each corresponding are composed suitably, and light of other various kinds of colors can be multicolor-emitted.

Meanwhile, in the embodiment described above, the back electrode 3 to be formed on the back base film 2 is arranged, with being disposed so that each minute stripe pattern is not confounded, but it is not needed necessarily. In addition, the electrode configuration can be suitably chosen from round, square or the like of stripe-shaped, too. The point is that the configuration is optional, if the ternary segmented electrodes 3a, 3b, 3c are formed in minute pattern with approaching and dispersing approximately uniformly.

In the present invention, as described above, an application field of an EL device in which optional light emitting colors are obtained, which is suitable for a colorful display apparatus, is expanded, by arranging an electroluminescence part which is disposed with laminating an illuminant layer and a transparent electrode on a back electrode comprising ternary segmented electrodes formed in a minute pattern which is dispersed approximately uniformly with approaching each other, and by arranging a light conversion layer comprising ternary light conversion elements which convert EL light from the electroluminescence part into three color of blue, green and red on the transparent electrode of this electroluminescence part, with corresponding the pattern of the back electrode.

[Brief Description of the Drawings]

Fig. 1 is a sectional view of a multicolor emitting field light emitting lamp according to the present invention.

Fig. 2 is a front view of a back electrode which is a part used in Fig. 1.

Fig. 3 is an emission spectrum distribution chart of Fig. 1.

Fig. 4 is an enlarged view of a relevant part to explain a luminescent principle of Fig. 1.

1 multicolor emitting field light emitting lamp

2 base film for back electrode (insulating substrate)

3a, 3b, 3c segmented electrodes

4 illuminant layer

5 transparent conductive film (transparent electrode)

7 light conversion layer

7a, 7b, 7c light conversion elements

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⑲ 日本国特許庁（JP）

⑪特許出願公開

⑫ 公開特許公報（A）

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審査請求　有

（全 4 頁）

⑤多色発光電界発光灯

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㉒出　　願　昭56(1981) 3 月23日

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明　細　書

発明の名称

多色発光電界発光灯

特許請求の範囲

絶縁基板上に形成され、夫々異る電源に接続される分割電極上に、発光体層と透明電極層及び前記分割電極に対応した位置に夫々異なる特性の光変換要素を配置した光変換層とを積層してなり、前記分割電極による発光を前記光変換層で色変換させたことを特徴とする多色発光電界発光灯。

発明の詳細な説明

この発明は電界発光灯、特に同一発光面で任意の色が得られる多色発光の電界発光灯に関する。

従来、電界発光灯（以下単にＥＬ装置と称す）は、少なくとも一方を透光とした一対の電極層間に、高誘電率のバインダ中に螢光体を分散した発光体層を介在させ、周囲を耐湿性の絶縁材で被覆した構造が採られ、小形軽量、薄形小電力消費等の特徴を有しており、種々の表示装置や液晶装置のバックライトとして使用されている。ところでこのように種々の優れた特徴を有したＥＬ装置も、その発光色は、主として発光体層に用いられる螢光体の種類で決まり、螢光体が有する特定の発光スペクトル分布を持つた発光がなされるもので、従来は主として高輝度高寿命が得られる緑色系のZnS・Cu系螢光体が用いられていた。そして、他の種々の色のカラー表示を得る方法としては、螢光体の組成を変えるか、カラーフィルタを用いるか、あるいは印加電源周波数を変える等の方法が試みられている。しかしながら、螢光体の組成をかえる方法は、これらの螢光体の発光効率や寿命特性が大きく異なり、490mμ～530mμに中心波長を有するZnS・Cu系螢光体以外のものは、発光効率が低く、寿命も短いため殆んど実用化なされていない。又、ＥＬ装置の発光面に種々の色のカラーフィルタをつけるものは、これらのフィルタが有する特定波長域以外の光を吸収するもので、一般に暗く

なる欠点がある他、上記方法はいづれも同一発光面で多種類のカラー表示が困難なものであつた。又、印加電源周波数を変える方法は、同一発光面で発光色が変えられるが、EL装置の電源が複雑になるばかりでなく、螢光体の発光スペクトル分布、つまり発光色を大きく変えることができず、結局表示色の可変範囲がきわめて小さいものであつた。このように、従来のEL装置は多色のカラフルな表示に不適であり、その利用分野もおのずから限定されるものであつた。

本発明は、以上に鑑みなされたもので、任意の発光色が得られると共に、一つのEL装置で、多種類の発光色が得られる新規なEL装置が提供される。以下本発明の実施例を図面と共に詳述する。

第1図は本発明に係る多色発光のEL装置1で、図に於いて、2は裏面電極用ベースフイルム、3はこのフイルム2上に形成された裏面電極で、第2図に示すように、3組の微細なストライプ状パターンを互に交絡しないように櫛形に配置してフイルム2上にほぼ均一に分散して形成した分割電極3a，3b，3cからなり、例えば樹脂製フイルム2上に印刷法や蒸着法又はメッキ法等で製造される。4はこの裏面電極3上に積層された発光体層で、490mμ～530mμに中心波長を有する高輝度の緑色系発光スペクトル分布のZnS・Cu系螢光体粉末をシアノエチルセルロースの高誘電体高分子に分散して形成した螢光体層や、チタン酸バリウムの高誘電体粒子をシアノエチルセルロースの高誘電体高分子に分散して形成した絶縁体層からなり、上記裏面電極3上に一様にスクリーン印刷して得られる。5は、透明導電膜で、例えばポリエステルフイルムからなる表面電極用ベースフイルム6上に酸化インジウムを被着形成したもので、透明電極層を構成する。そしてこの透明導電膜5と裏面電極3は発光体層4を両面より挟み込んだ構造で、両者に電圧印加することにより、電圧印加された部分の螢光体が励起され、第3図の曲線aに示すように、略520mμにピークを持ち400mμ～650mμの発光スペクトル分布の緑色のEL光が透明導電膜5側に放出される。7は透明電極のベースフイルム6上に形成された光変換層で、上記EL光を夫々青色光(420～490mμ)，緑色光(490～560mμ)及び赤色光(590mμ～)に変換する青色フイルタ要素7a，緑色フイルタ要素7b及び赤色波長変換要素7cの3つの要素から構成され、各要素7a，7b，7cは前記3組の微細なストライプ状裏面電極3a，3b，3cに対応させて同様に櫛型パターンに形成される。第3図の曲線x，y及びzは、これらの青色フイルタ要素7a，緑色フイルタ要素7b及び赤色波長変換要素7cにより、上記曲線aで示すEL光を光変換した実測データで、夫々400mμ～520mμの青色、470mμ～620mμの緑色及び570mμ～720mμの赤色の三原色が得られる。この光変換層7の各要素7a，7b，7cは、光の吸収・透過特性や波長変換特性を適当に選定した螢光シートや螢光顔料を用い、接着又は印刷手段で容易に形成することができる。

ここで特に注目すべき点は、螢光体に略520mμにピークを持ち、400～650mμの発光スペクトル分布を持つ発光効率の高いZnS・Cu系螢光体を用いたから、青色フイルタ要素7a及び緑色フイルタ要素7bを用いることにより、上記EL光の発光スペクトルを二分した形で400～520mμの発光スペクトル分布を持つ緑色光と470～620mμの発光スペクトル分布を持つ青色光が夫々高輝度で得られる他、上記EL光では得られない590mμ以上の高波長の赤色は、赤色波長変換要素7cを用いて上記EL光を波長変換することにより、570～720mμの発光スペクトル分布を持つ高輝度の赤色光が得られる点である。次に8及び9は内部を保護する樹脂外皮フイルムで、裏面フイルム2と表面の変換層7の両側から挟み込み、周縁部で封着したものである。又、表面の外皮フイルム8はその表面が凹凸に形成されていて、上記光変換層7で変換されたEL光を外部に乱反射して放出する光拡散板を兼ねている。

次にこのような構成の多色発光のEL装置1の動作について述べる。先ず第4図に於いて、裏面の分割電極3aと透明導電膜5間に電圧印加すると、この間に積層された発光体層4の螢光体が励

起され、第3図曲線aに示す視感度の高い緑色光で発光する。この発光は微視的には分割電極3aの櫛状のストライプ状パターンで発光するが、巨視的に見た場合、分割電極3aが裏面ベースフイルム2上に微細なパターンでほぼ均一に分散して形成されているため、殆んど均一な全面発光と同様に見えるものである。そしてこの櫛状パターンの緑色光は、透明導電膜5を透過して前面のベースフイルム6上に裏面分割電極3aに対応して形成された微細なストライプ状パターンの光変換層7の青色フイルタ7aに入射する。そしてこの青色フイルタ7aで青色以外の波長が吸収され、第3図の曲線xに示す青色光が表面外皮8側に放出される。そして外皮フイルム8で乱反射され、表示面全面に均一な青色光が放出される。同様にして他の分割電極3b，3cと透明導電膜5間に電圧印加すると、夫々表示面に均一な緑色光や赤色光が放出される。又分割電極3a，3b，3cを適宜組合せしてこれらの電極と透明導電膜5間に電圧印加すると夫々対応する光変換層7の各変換要素7a，7b，7cで変換された青色光，緑色光，赤色光が適宜合成され、他の種々の色の光を多色発光させることができる。

尚上記実施例で、裏面ベースフイルム2上に形成する裏面電極3は、微細なストライプ状パターンを互に交絡しないように配置して構成したが、必らずしもその必要はなく、又電極形状もストライプ状の他円形，角形等適宜選定でき、要は微細なパターンで3組の分割電極3a，3b，3cが近接してほぼ均一に分散して形成されれば、その形状は自由である。

本発明は以上のように、互に近接してほぼ均一に分散してた微細パターンに形成された3組の分割電極からなる裏面電極上に発光体層と透明電極を積層配置した電界発光部と、この電界発光部の透明電極上に、前記裏面電極のパターンに対応させて、前記電界発光部からのEL光を青色，緑色赤色の三色に変換する3組の光変換要素からなる光変換層を配置したから、任意の発光色が得られ、カラフルな表示装置に好適しEL装置の利用分野が拡大する。

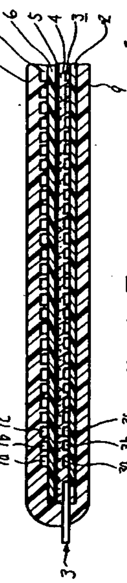
図面の簡単な説明

第1図は本発明の多色発光型電界発光灯の断面図、第2図は第1図に使用する部品で裏面電極の正面図、第3図は第1図の発光スペクトル分布図、第4図は第1図の発光原理を説明する要部拡大図である。

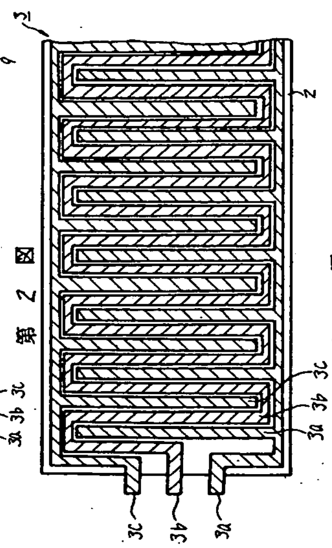
1……多色発光電界発光灯
2……裏面電極用ベースフイルム（絶縁基板）
3a，3b，3c……分割電極
4……発光体層
5……透明導電膜（透明電極）
7……光変換層
7a，7b，7c……光変換要素

特許出願人　新日本電気株式会社

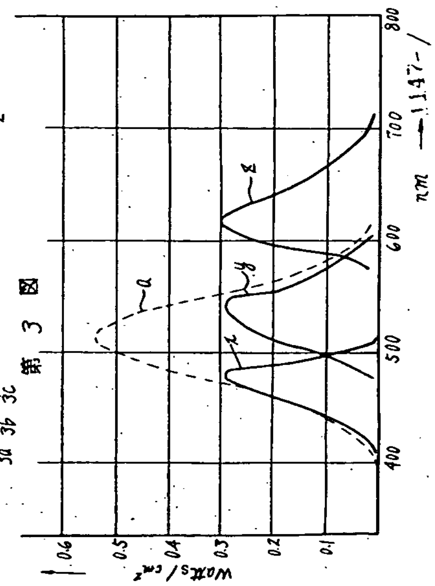
第1図



第2図



第3図



第 4 図